INVESTIGATION CONCLUSION
ANOMALOUS SOIL SAMPLES
AT HUNTERS POINT NAVAL SHIPYARD
Revision 1

April 2014

HUNTERS POINT NAVAL SHIPYARD
SAN FRANCISCO, CALIFORNIA

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EXECUTIVE SUMMARY

This report summarizes the investigation results and corrective actions taken by Tetra Tech EC, Inc. (TtEC) in response to a Navy inquiry into discrepancies between the first two sets of systematic sample results and the third set at the Former Building 517 site located at Hunters Point Naval Shipyard (HPNS).

The discrepancy was first identified during a routine telephone call on October 4, 2012. On that call, a Navy official with the Radiological Affairs Support Office (RASO) suggested that the third set of systematic samples for Survey Unit 2 within the Former Building 517 footprint (B517 SU-002) had been collected from locations different than the ones specified in the Final Status Survey Report. The conclusion was based on final systematic (post-remediation) soil sample results reported by the the on-site Department of Defense accredited laboratory. These results reported low potassium-40 (K-40) sample activity (i.e., < 5 picocuries per gram) coupled with low activity for radium-226 (Ra-226), bismuth-214 (Bi-214), and lead-214 (Pb-214) in 36 out of 36 samples. The set of systematic samples were purportedly collected post-remediation at a depth no more than 6 inches below ground surface (bgs). Since the on-site laboratory results were replicated by the off-site gamma spectroscopy laboratory, TestAmerica-St. Louis, the possibility of instrument error as the cause of the anomalous results was ruled out.

TtEC immediately responded to the Navy inquiry by conducting an investigation to determine the source of the discrepancy. The first step of the investigation consisted of potholing adjacent to the four locations reporting anomalous results in order to determine whether a contiguous fill layer was present near the surface and to compare soils observed in the potholes with those of the original final systematic samples, which had been archived. The final (or third) set of systematic samples was uniformly gray in color and similar to Franciscan-derived fill material.

Multiple lithologies were encountered in each pothole, and contiguous layers were not observed from location to location. Only one pothole contained light grayish soil similar to the archived material. Additional locations were potholed and sampled at multiple depths to determine whether the samples had been potentially collected at depths other than those indicated on the chain-of-custody (COC). Only 2 of 24 samples reported similar low K-40 concentrations and both were collected at depths greater than 6 inches bgs.

The second step of the investigation was to conduct a database review to identify other survey units with large proportions of low K-40 soil sample results. Over 70,000 results reported since 2008 were queried and approximately 2,500 samples were identified as meeting the criteria of low K-40 (< 5 picocuries per gram). The 2,500 results were then evaluated to determine whether the concentrations correlated with previous sample sets from the same area. Based on this evaluation, an additional 12 survey units at 3 additional sites in Parcels C and E were identified as survey units for which a high probability existed that the soil samples were not representative of the respective survey units. Seven other locations reported anomalously low K-40 concentrations for some samples within systematic sample sets and were identified for potential further evaluation as well.

Since laboratory error and subsurface conditions were ruled out as the cause of the discrepancies in K-40 results, the next step consisted of conducting interviews with sampling personnel to determine if human error was the cause. The TtEC Radiation Safety Officer (RSO) and the

Program Quality Control Manager (PQCM) conducted interviews with the individuals listed on the COCs, direct supervisors, members of the sampling crews, and laboratory workers. The results of the interviews were inconclusive.

Since the interviews did not provide any information on how the discrepancies in K-40 could have occurred, the investigation looked into the physical features of the suspect samples, including color and grain size. This investigation began at B517 SU-002. The samples with low K-40 from B517 SU-002 were uniformly gray in color and had similar grain size. The RSO, PQCM, site RSO Representative, and the Construction Manager conducted a site inspection at B517 SU-002, the North Pier, the former Building 707 Triangle Area, and various import fill piles to attempt to discern if the source of the low K-40 samples may have come from a stockpile or other convenient material source located on the site. Soil samples were collected from the North Pier, the former Building 707 Triangle Area, and the various import fill piles located at HPNS and were analyzed to determine if they had a similar radionuclide signature. Low K-40 values similar to those reported in the anomalous sample sets were found in samples of road base from the former Building 707 Triangle Area. The material's color was also similar to the suspect soil from B517 SU-002.

Subsequent investigation of other potential source materials and analyses revealed that grayish green drill cuttings found stockpiled on the ground floor of Building 253/211 have both lithologic and radioanalytical characteristics consistent with the suspect soil. The significance of this discovery was that if individuals decided to substitute samples from one source, it would be easier to do so within the confines of a building where the actions are less likely to be observed by others. Either the former Building 707 Triangle Area or the Building 253/211 drill cuttings, or a combination of both, may have been used as substitute soil samples; however, the investigators were unable to conclusively determine a source.

TtEC also resampled the 12 survey units with samples that were likely to not be representative of the survey unit, and four of the seven potential further evaluation sites, as identified in the database search. While duplicate soil samples are rarely correlative, the resampling was performed to provide representative soil sample data sets to compare against the anomalous results. Results from the resampling indicated significant differences in the K-40 values, which suggest that the initial data collected from those survey units may not have been representative of these survey units.

The remaining three potential further evaluation survey units that were not resampled were trench survey units. Uniform soil sample results are possible due to the complex fill history of HPNS, such as in samples collected from subsurface trench survey units where large lenses of homogeneous material are located. In addition, it is not unusual to have soil samples with low concentrations of K-40 in areas within HPNS, especially in samples collected from materials that have been derived from the Franciscan Formation or samples collected directly from the Franciscan bedrock. Soils and bedrock associated with the Franciscan are a distinctive dark gray to grayish green color. These materials are observed in the areas within Parcel C where the three former trench survey units identified for potential further evaluation are located.

Based on the investigation activities above, TtEC initiated a series of corrective actions as follows:

- Sampling personnel on the COC forms for anomalous samples were removed from TtEC projects. The two TtEC health physics supervisors responsible for the soil sample collection work were disciplined. All other project management personnel involved in the sampling process, including the project management team, quality control team, and radiation safety team, were issued letters of caution.
- All individuals directly involved in soil sample collection at HPNS attended refresher training on proper soil sample collection per the Sampling and Analysis Plan and Standard Operating Procedure (SOP) HPO-Tt-009, as well as proper filling out of COC forms.
- All individuals involved in soil sample collection, as well as every TtEC employee and subcontractor on the HPNS site, attended training on ethical behavior.
- TtEC resampled all 12 survey units recommended for resampling. Any survey units exhibiting activity concentrations exceeding the release criterion for a respective radionuclide of concern were remediated and resampled until all release criteria were met. All suspect data, including anomalous soil sample data and gamma static survey results, were rejected.
- TtEC resampled four of the seven locations identified for potential further investigation. These seven locations reported anomalously low K-40 concentrations for some samples within systematic sample sets. Further evaluation of photographs and samples from the remaining three trenches indicated that the low K-40 was likely due to the distinct Franciscan Formation visible in these trenches. The color and gradation of the samples from these trenches also support that they are from the Franciscan Formation.
- A protocol has been implemented that ensures a member of the HPNS quality control team conducts a surveillance of a minimum of 10 percent of final systematic sample collection. Issues identified during the surveillances are documented and corrected.
- A protocol has been implemented for the corporate RSO to be notified if sampling result trends are inconsistent with previous sampling results. This protocol includes K-40 and other radionuclides that are not radionuclides of concern.

Completion of these corrective actions has resulted in consistent, high-quality Final Status Survey results. These corrective actions ensured that additional samples have been collected and handled in full compliance with the Sampling and Analysis Plan. TtEC has not had a recurrence of the type of soil sample results that led to this investigation, indicating that the corrective actions have addressed the problem.

A chronology of events is presented on the following pages, beginning with identification of the data discrepancy in early October 2012 and ending with the responses to Navy comments incorporated into this April 2014 revised report.

INVESTIGATION CHRONOLOGY

October 4, 2012 — DATA DISCREPANCY IDENTIFIED

- During a phone call with the Navy, the Radiological Affairs Support Office points out a possible discrepancy in sampling results from the Survey Unit 2 within the Building 517 footprint (B517 SU-002).
- Anomalous samples have atypically low concentrations of K-40, Ra-226, Pb-214, and Cs-137.
- The possibility of laboratory instrument error is ruled out.
- TtEC pulls together a team to investigate.

October 5 through 8, 2012 — POTHOLING

- Potholes are excavated at four of the sample locations with anomalous results to determine if the samples were from the prescribed sampling depth.
- Multiple lithologies are encountered in each pothole.
- The hypothesis that individuals sampling soil may have sampled bedrock soil with low concentrations of K-40, Ra-226, and its progeny is not supported by potholing observations.

October 16, 2012 — SUBSURFACE SAMPLING

- Additional locations are potholed and sampled.
- Results do not support the hypothesis that the individuals may have sampled bedrock soil with low concentrations of K-40, Ra-226, and its progeny.
- The Corporate RSO and others review soil sample data from other HPNS sites around the former Building 517 Site.

October 15 through 19, 2012 — DATABASE REVIEW

- Investigative team members review soil sample results from the on-site database looking for similar anomalous data.
- The data review shows a pattern of consecutive samples with uncharacteristically low K-40, Ra-226, and progeny concentrations in 12 survey units at 3 additional sites in the Parcel C and E areas.
- The scope of the investigation is expanded to cover other survey units.

October 24 through November 28, 2012 — SYSTEMATIC SAMPLING

- The QCPM oversees the resampling of the systematic samples at B517 SU-002.
- The investigative team takes action to collect systematic samples in these areas to determine if the radionuclide signature of low K-40, Ra-226, and progeny could be replicated.
- The systematic sample results are substantially more elevated than the anomalous set of systematics, suggesting that the anomalous set of systematic samples is not representative of its respective survey unit.

Week of November 5, 2012 — INTERVIEWS

- To investigate the possibility of human error, the RSO and QCPM conduct interviews with individuals on the COCs for the anomalous soil sample results.
- Also interviewed are TtEC Health Physics Supervisors, subcontracted Radiation Control Technicians (RCTs), laboratory employees, quality control personnel, and the basewide supervisor.
- All individuals interviewed claim that all appropriate soil sampling techniques were used and all work was completed in an ethical manner.

November 7, 2012 — INSPECTION OF SITES WITH ANOMALOUS DATA

- Investigative team members conduct a visual inspection of soil surfaces at B517 SU-002, examine import fill soil, examine the North Pier, and examine the former Building 707 Site.
- The exposed layer of "road base" at the former Building 707 Site is found to be similar in color and composition to the anomalous soil samples from B517 SU-002.